

WHAT IS CLAIMED IS:

1. A method of manufacturing a semiconductor device comprising:

forming an element isolation trench in a semiconductor substrate by using a mask member;

forming a first film on said semiconductor substrate by a coating method to fill said element isolation trench with said first film;

evaporating a solvent contained in said first film to convert said first film into a second film;

removing part of said second film which is deposited on said mask member by CMP, thereby permitting a surface of said mask member to expose while selectively leaving behind part of said second film which is buried in said element isolation trench; and

subjecting said second film buried in said element isolation trench to burning oxidation treatment in an atmosphere containing water vapor.

2. The method of manufacturing a semiconductor device according to claim 1, wherein said burning oxidation treatment is performed at a temperature of 200°C or more.

3. The method of manufacturing a semiconductor device according to claim 2, wherein said burning oxidation treatment includes a low temperature heat treatment wherein the temperature thereof is maintained

within the range of 200°C to 450°C and a high temperature heat treatment wherein the temperature thereof is maintained within the range of 450°C to 1000°C.

5 4. The method of manufacturing a semiconductor device according to claim 1, wherein said second film is buried in said element isolation trench in a manner that a distance between a bottom of said element isolation trench and a surface of said second film is
10 limited to 600 nm or less.

 5. The method of manufacturing a semiconductor device according to claim 1, wherein said first film is formed of silazane perhydrogenated polymer, and said second film is formed of polysilazane, said second film
15 being adapted to be converted into a silicon oxide film as it is subjected to said burning oxidation treatment.

 6. The method of manufacturing a semiconductor device according to claim 1, wherein said second film is heat-treated at a temperature ranging from 200°C to
20 450°C in an atmosphere containing water vapor to perform a CMP resistance-giving treatment thereof prior to said removal of part of said second film deposited on said mask member by CMP.

 7. The method of manufacturing a semiconductor device according to claim 6, wherein said CMP
25 resistance-giving treatment of second film is performed at a temperature ranging from 350°C to 450°C in

an atmosphere containing water vapor.

8. The method of manufacturing a semiconductor device according to claim 1, wherein said second film is subjected to a densification treatment which is
5 effected through a heat treatment thereof at a temperature ranging from 800°C to 1100°C subsequent to said burning oxidation treatment of said second film.

9. The method of manufacturing a semiconductor device according to claim 8, wherein said mask member
10 is removed from said semiconductor substrate to permit sidewalls of said second film to expose prior to said densification treatment.

10. A method of manufacturing a semiconductor device comprising:

15 forming an element isolation trench in a semiconductor substrate by using a mask member;

coating a solution of silazane perhydrogenated polymer on a surface of said semiconductor substrate by a coating method to fill said element isolation trench
20 with a coated film containing said silazane perhydrogenated polymer;

heat-treating said coated film to permit a solvent contained therein to evaporate, thereby converting said coated film into a polysilazane film;

25 removing said polysilazane film deposited on said mask member by CMP, thereby permitting a surface of said mask member to expose while permitting said

polysilazane film to selectively remain inside said element isolation trench; and

subjecting said polysilazane film to heat treatment to form a silicon oxide film.

5 11. The method of manufacturing a semiconductor device according to claim 10, further comprising:

removing said mask member deposited on said semiconductor substrate subsequent to forming said silicon oxide film; and

10 heat-treating said silicon oxide film to enhance a density of said silicon oxide film.

12. The method of manufacturing a semiconductor device according to claim 10, wherein said forming silicon oxide film is performed by a burning oxidation treatment wherein said silicon oxide film is
15 heat-treated at a temperature of 350°C or more in an atmosphere containing water vapor.

13. The method of manufacturing a semiconductor device according to claim 12, wherein said burning
20 oxidation treatment includes a low temperature heat treatment wherein the temperature thereof is maintained within the range of 350°C to 450°C and a high temperature heat treatment wherein the temperature thereof is maintained within the range of 450°C to
25 1000°C, both heat treatments being performed in an atmosphere containing water vapor.

14. The method of manufacturing a semiconductor

device according to claim 11, wherein said heat treatment for enhancing the density of said silicon oxide film is performed at a temperature ranging from 800°C to 1100°C.

5 15. A method of manufacturing a semiconductor device comprising:

 peelably forming a dielectric film having a flat surface on a surface of a base film;

 forming a step portion on a surface of
10 a semiconductor substrate;

 placing said dielectric film on said semiconductor substrate having the step portion and applying heat and pressure to said dielectric film;

 peeling said base film from said dielectric film
15 to obtain said semiconductor substrate having said step portion buried with said dielectric film, thus forming a dielectric film having a flat surface; and

 subjecting said dielectric film to burning oxidation treatment in an atmosphere containing water
20 vapor.

 16. The method of manufacturing a semiconductor device according to claim 15, wherein said step portion is formed on said semiconductor substrate as at least one of the features selected from an element isolation
25 trench, a gate electrode and a wiring layer.

 17. The method of manufacturing a semiconductor device according to claim 16, wherein said step portion

is constituted by an Al wiring layer, and said burning oxidation treatment is performed by a heat treatment in an atmosphere containing water vapor wherein the temperature thereof is maintained in a range of 200°C to 400°C.

18. The method of manufacturing a semiconductor device according to claim 17, wherein said heat treatment is performed in an atmosphere containing water vapor at a temperature of 350°C or more to form a layer of Al_2O_3 around said Al wiring layer.

19. The method of manufacturing a semiconductor device according to claim 15, wherein said burning oxidation treatment is performed at a temperature of 200°C or more.

20. The method of manufacturing a semiconductor device according to claim 19, wherein said burning oxidation treatment includes a low temperature heat treatment wherein the temperature thereof is maintained within the range of 200°C to 450°C and a high temperature heat treatment wherein the temperature thereof is maintained within the range of 450°C to 1000°C.

21. The method of manufacturing a semiconductor device according to claim 16, wherein said dielectric film is buried within said step portion in a manner that a distance between a bottom of said element isolation trench and a surface of said dielectric film

is limited to 600 nm or less.

22. The method of manufacturing a semiconductor device according to claim 15, wherein said dielectric film is formed of polysilazane, which is adapted to be converted into a silicon oxide film as it is subjected to said burning oxidation treatment.

23. The method of manufacturing a semiconductor device according to claim 22, further comprising depositing a film of low moisture permeability on a surface of said silicon oxide film.